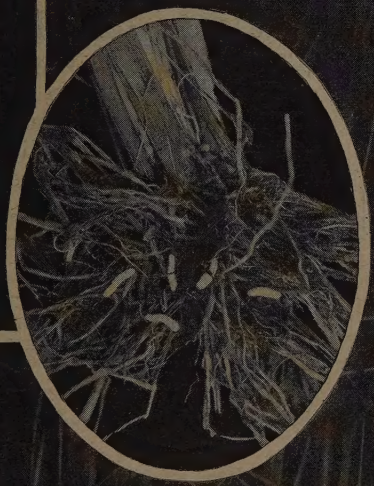
FARMERS' BULLETIN 1086
UNITED STATES DEPARTMENT OF AGRICULTURE

HOW INSECTS AFFECT THE RICE CROP



THE slender, milk-white grub or "maggot" of the rice water-weevil lives on the roots of rice, and whether it feeds little or much upon them, kills practically all the roots that it attacks. This pruning of the roots weakens the rice plant and often kills it.

Another enemy of this staple crop of the South is the stink bug, which sucks the juices from the soft grains of rice.

The fall army worm, when it becomes abundant, works great havoc in its attack upon young rice. Other insects also, such as the rice stalk-borer, infest the rice field, and the rice planter must constantly guard his crop against them.

This bulletin tells when to plant, and when to flood and drain the fields in order to reduce the numbers of these pests, and recommends other measures that will prevent attack by the many minor species of insects which normally breed in and near rice fields.

Contribution from the Bureau of Entomology
L. O. HOWARD, Chief
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HOW INSECTS AFFECT THE RICE CROP.[1]

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CONTENTS.

	Page.		Page.
Some insects infest rice fields almost every year	3	The rice stalk-borer kills the plant	8
The rice water-weevil lives on the roots	4	Miscellaneous insects which at times injure the rice crop	9
The stink bug injures the yield	7	The best methods of insect control in rice fields	9
The fall army worm or southern grass worm injures rice	8		

SOME INSECTS INFEST RICE FIELDS ALMOST EVERY YEAR.

EVERY great staple crop when grown in abundance in large areas becomes affected by many serious pests. This is sometimes because of the greater succulence of cultivated crops and sometimes because the insects of the neighborhood which normally would attack native plants are forced either to starve or adapt themselves to the plant growth which is most numerous. The result is that every few years some "new pest" becomes serious on one of our staple crops. This adaptation often happens very suddenly, as when new land is broken and cultivated and all the native insects are at once forced to attack the new crop.

Even rice, with its unusual system of agriculture, occasionally is very seriously affected by insect pests. For example, a new rice section was opened up in Texas a few years ago and a billbug,[2] which never before had been collected on any plant and was considered very rare, suddenly became serious and destroyed large plantings. But it disappeared as suddenly when the new rice was flooded and never has been heard of since.

Some enemies of rice, however, are to be found in the fields almost every year and at times cause great losses to the crop. These will be discussed in greater detail in the following pages.

[1] The insects discussed in the following pages are fairly common in the rice fields of Louisiana, Texas, and Arkansas, but have not yet been found in the rice fields of California.

[2] (*Calendra*) *Sphenophorus oblitus* Lec.

THE RICE WATER-WEEVIL LIVES ON THE ROOTS.

Rice roots are attacked by the "maggot," or larva, of the water weevil,[1] which is rather generally distributed throughout the rice belt. The amount of damage done yearly to the rice crop by the rice water-weevil is extremely hard to estimate. In most cases no rice is killed outright, and yet practically every rice field is infested to a greater or less degree.

The effect of the weevil attack is the pruning off of the roots near the base of the stalk. In severe attacks all the roots may be cut off, in others only a few. Where the pruning is not too severe, the rice plant promptly throws out new roots, continues to live, and will ma-

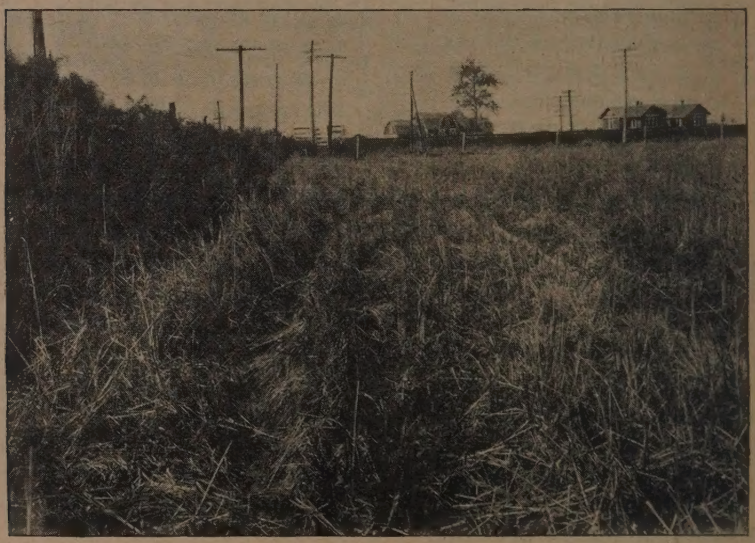

FIG. 1.—Overwintering quarters of the rice water-weevil.

ture. In extreme cases the rice plants are killed and the loss is then easier to estimate. In general the loss from this source is considerable, and well worth active efforts in the way of prevention or elimination.

THE WEEVIL.

The adult weevil passes the winter in dead grass (fig. 1), especially grass that is matted down upon the ground. In order to find the weevils in hibernation, that is, in their winter sleep, the grass must be lifted up and thoroughly shaken out, causing them to fall to the ground. Even then close examination is necessary in order to distinguish them, as their general color is much the same as that of the

[1] *Lissorhoptrus simplex* Say.

dry grass. Great numbers of weevils pass the winter in the dried grass.

In southern Louisiana the weevils begin to come out from their winter quarters rather early. The earliest date upon which an adult has been observed to be active is March 25. The latest date upon which adults were found dormant was June 26. This gives a period of three months for the emergence of the entire generation of overwintering individuals.

The adult weevils are usually not noticed in spring until the first flooding of the rice fields. Then almost immediately they are to be found swimming about in the water among the rice plants or resting upon the leaves above water. Sometimes they apparently rest upon the leaves for hours, but when touched promptly "play possum," fall to the water, and swim away. They appear to be equally at home in water and out of it. It is impossible, however, for them to breed in any but water plants.

Feeding.—The first injury to the rice plant occurs upon the leaves and is caused by the feeding of adult weevils just before and after egg deposition. This injury takes the form of longitudinal feeding scars, the weevil eating out a furrow in the leaf just as broad as the spread of the mandibles. Only the thin outer skin of the underside is left. Little real damage is caused in this way, but the work is very characteristic of this species.

Egg laying.—Mating and egg laying apparently commence shortly after the adults reach the flooded fields of rice. When ready to deposit an egg the adult female crawls down the rice stem beneath the water and surface of the soil to one of the principal roots. Here she inserts the ovipositor, apparently by merely forcing the tip of this organ through the epidermis or outer layer of skin of the root. The egg is then placed longitudinally just under the epidermis. It is cylindrical, pearly white, and about one thirty-second of an inch in length. It is three or four times as long as broad and barely visible to the naked eye. From the egg in a few days there hatches a minute legless grub or larva.

THE LARVA.

For the first few days of its existence the larva remains within the root in which it was hatched, feeding upon the inner root tissues and increasing in size. It advances along the root longitudinally, eating out a passageway as it goes. By the time it has exhausted the nutritive qualities of this first root it is large enough to proceed farther, and goes to another root, undeterred by the surrounding mud. (See fig. 2.) Whether it feeds little or much upon successive roots, practically all roots attacked are killed. Often several larvæ

are found among the roots of a single plant and work great destruction there. At this stage many of the larvæ are easily disclosed by pulling up infested rice plants and shaking the roots in water until washed clean of mud. (See fig. 3.) Some of the larvæ float on the surface of the water, others sink to the bottom. When the roots of a rice plant are severely injured the leaves turn yellow, and may even fall over upon the surface of the water.[1]

When full grown the larva is from one-fourth to one-half inch in length, very slender, and milk white.

FIG. 2.—Rice root "maggots" among the roots of a rice plant.

THE PUPA.

In preparation for the change to the pupal or resting stage, the larva gathers about itself an egg-shaped mass of dirt, which it attaches to one of the healthy rice roots. (See fig. 4.) The outside of this cell is uniformly even and oval in shape, and is composed of dirt and a secretion from the weevil larva which makes it impervious to water. Within the pupal cell, safe from water, the larva spins a thin silken cocoon about itself as if to make itself doubly secure, for it is delicate and helpless while it undergoes, during its pupal period, the difficult transformation into the adult-beetle stage. As many as 15 pupal cells have been found attached to the roots of one rice plant.

The pupa shows somewhat the form of the adult, but it is entirely white, like the larva. The duration of the pupal stage is probably from one to two weeks. When fully mature the adult breaks through the wall of the pupal cell, crawls up the root to which the pupal cell was attached, and so escapes to the open air.

LENGTH OF LIFE CYCLE.

The length of time the insect spends in each of these four stages is not definitely known; however, the time from deposition of the

[1] Tucker, E. S., The rice water weevil and methods for its control. U. S. Dept. Agr. Bur. Ent. Circ. 152, 1912.

egg to the young adult stage in the spring has been determined approximately. In a plot of rice which was first flooded on June 1, 1912, a young adult was found in a pupa case on July 8, 1912.

The egg could not have been deposited before the rice was flooded, and, supposing it to have been deposited the first day of flooding (June 1), the time occupied in reaching the adult stage by July 8 was 38 days, or 5½ weeks. It is, of course, possible that even less time than this was actually occupied by the insect in passing through the different stages.

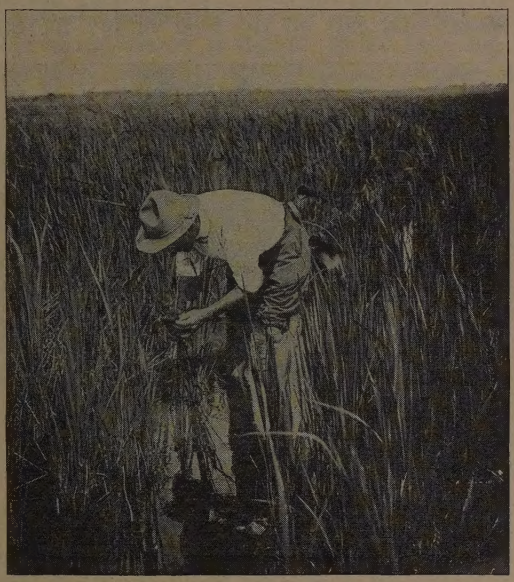

FIG. 3.—Examining rice roots, after first washing off the mud, for root "maggots."

CONTROL BY DRAINAGE.

Careful experiments have demonstrated that drainage is the safest remedy for the rice water-weevil. The proper time to commence drainage of the fields is from two and one-half to three weeks after the first flooding, while the larvæ are still young. Drainage should continue for a period of two weeks. A shorter period of drainage will not kill the larvæ, and a longer period will injure the rice. Planters should not wait until the rice begins to turn yellow before commencing to drain. The damage is practically all done by that time, and the rice needs water to enable it to throw out new roots and recover from the attack of the insect.

THE STINK BUG INJURES THE YIELD.

Rice growers are familiar with an elongate, straw-colored bug, with mouth parts fitted for piercing and sucking, which is known as the stink bug.[1] As the name indicates, it has a very offensive odor which becomes apparent when one handles the insect. Its life history in relation to the rice plant has not been worked out in detail. Its injury to this crop is largely confined to late summer and early fall when the rice heads are forming, the mature and

[1] *Oebalus pugnax* Fab.

nearly mature bugs attacking the soft grains of rice, sucking the juices from them by means of the beak, which lies concealed under the body when at rest.

A good deal of the injury and loss from this source can no doubt be avoided by getting the crop in early in the spring so as to bring it to maturity before the bugs become abundant in the fall. A wise precaution is to keep down weed growth surrounding the fields, which reduces the food supply during the summer for the younger stages, and cuts off the food supply for the adults after the rice is harvested. Fall weed cutting is especially important for this reason.

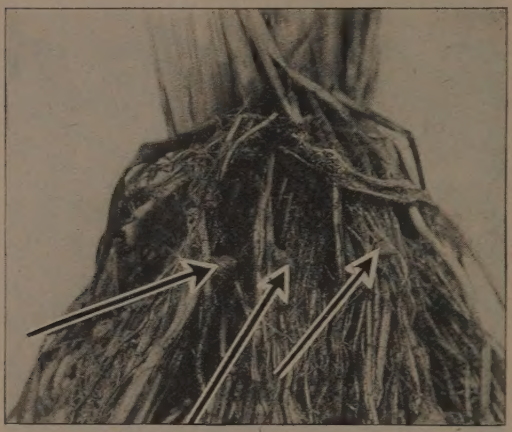

FIG. 4.—Pupal cells of the rice water-weevil attached to rice roots.

THE FALL ARMY WORM OR SOUTHERN GRASS WORM INJURES RICE.

Southern planters are bothered almost every year with the grass worm,[1] and in some years the pest is a veritable plague. This insect, which resembles the true army worm of the North, and attacks practically all kinds of vegetation, occasionally becomes abundant in rice fields in the spring before the rice is flooded. Unless prompt measures are taken it soon works great havoc, as it is a voracious feeder, and the young rice seems to be especially palatable to it. It is easily controlled by the simple method of flooding the fields and drowning out the worms. After flooding there is little danger of an invasion, as it is impossible for the worms to reach the plants through the water surrounding the fields.

THE RICE STALK-BORER KILLS THE PLANT.

After the rice has headed out, there will be found in most fields, if one looks closely, occasional single white heads among the surrounding green or yellowish ones. An examination of the stalk below the head will usually reveal the larva or pupa of the stalk borer[2] within the stalk. The larva feeds on the inner stalk and the head dies before maturity.

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[1] *Laphygma frugiperda* S. & A.

[2] *Chilo plejadellus* Zincken.

The adult form of this insect is an elongated moth of a pale yellow color with golden patches and scales, having a row of black dots at the end of each front wing. The eggs are evidently laid on the leaves, and on hatching the larva crawls down and bores into the stalk.

The appearance of infested plants resembles somewhat that of diseased plants, but in the case of attack by the borer some of the leaves, as well as the head, usually will be found dry and withered, which is not the case in diseased heads.

The damage from the rice stalk-borer is slight. It has been suggested that, in case of heavy infestations, the best way to rid a plantation of the borer is after harvest to cut, as close to the ground as possible, the stubble, volunteer rice, and weeds, and to burn them thoroughly in some safe place.

MISCELLANEOUS INSECTS WHICH AT TIMES INJURE THE RICE CROP.

The most destructive insect enemies of the rice crop already have been mentioned. Several others, not so generally present, occasionally increase in numbers to such an extent as to cause injury to the crop. Among them are the Southern corn rootworm,[1] which sometimes attacks the rice seed after it is planted, completely destroying its power to produce a plant.

A black beetle, which also attacks corn, known as the rough-headed corn stalk-borer,[2] is sometimes found in rice fields. It attacks the main stem of the rice plant just above the roots, shredding it and causing the plant to die.

In addition to the above-mentioned insects, various sucking bugs, caterpillars, grasshoppers, and leafhoppers prey upon the crop, although as a usual thing damage by them is so slight as to escape notice.

THE BEST METHODS OF INSECT CONTROL IN RICE FIELDS.

(1) Plow fields in fall previous to planting time to kill pests in the soil. In the case of sod land, cultivate thoroughly in the fall. If fall plowing is not done, burn off all vegetation during winter to destroy pests overwintering in the dead grass and weeds.

(2) Three weeks after first flooding, drain fields for two weeks to prevent damage by "root maggots."

(3) In case of caterpillar or worm attack upon the leaves, flood the field immediately.

(4) Keep down all weed growth around the field and on the levees separating the plats. This will greatly reduce attack by many minor species of insects which normally breed in these weeds.

[1] *Diabrotica 12-punctata* Oliv.

[2] (*Ligyrus*) *Euetheola rugiceps* Lec.

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